DETAILED ACTION

Status of Claims

Claims 1-8, 10, 12-16 and 18-21 are cancelled, Claims 9 and 11 are currently amended, and Claim 17 is as previously presented and Claims 22-32 is new.

Claim Objections

Claim 22 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. In Claim 22, applicant includes Cr in the formula, but recites that the steel is devoid of Cr in parent Claim 9.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 24 and 28 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In Claim 24, it is unclear if the recitation of "a hardened layer" is a result from the hardening step in Claim 9 or some other hardening. For examination, the examiner will assume the hardening is from Claim 9.

Claim 28 recites the limitation "0.20×Cr" in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 9, 11, 17 and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanisawa et al (US 6,547,890 B2) in view of Makino et al (US 2002/0173363 A1), Ishida et al (US 2002/0139451 A1) and Ochi et al (US 6,383,311 B1).

Kanisawa et al teaches a steel wire rod with the following composition (abstract; column 4 to column 5) with respect to the claims in wt%:

Element	Claim 9	Claim 11	Claim 22	Kanisawa et al
C	0.45-0.55%			0.1-0.5%
Si	0.21-0.45%			0.01-0.5%
Mn	0.50-1.20%			0.3-1.5%
P	0.025% or less			0.035% or less
S	0.025% or less			0.035% or less
Mo	0.15-0.25%			0.1-1.0%
B	0.0005-0.005%			0.005% or less
Ti	0.005-0.010%			0.005-0.04%
N	0.015% or less			not taught
Nb		$\leq 0.20\%$		0.005-0.1%
Ta		$\leq 0.20\%$		reads on 0
Zr		$\leq 0.10\%$		reads on 0
C_{eq}			0.80-0.95	0.2207-1.495

In the case where the claimed ranges overlap or lie inside ranges disclosed by the prior art, a *prima facie* case of obviousness exists. See MPEP § 2144.05. The steel rod comprises ferrite, pearlite and bainite (Claim 2, lines 54-57). The area reduction of 20% or larger occurs at a

minimum temperature of 750 C (Table 3). The material hardness is controlled to 250-700 Hv (column 4, lines 21 and 22), which is 22-60 HRC. Regarding Claim 17, Kanisawa et al overlaps the claimed range. Regarding Claim 23, Kanisawa et al does not teach the range of ferrite area, but teaches the presence of ferrite. It would have been obvious to one of ordinary skill in the art at the time the invention was made to expect that the amount of ferrite in Kanisawa et al would be within the claimed range, since Kanisawa et al teaches the same rolling conditions. Additionally, a particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation; therefore a *prima facie* case of obviousness exists. See MPEP § 2144.05 II B. However, Kanisawa et al does not teach high frequency hardening in Claims 9 and 24 the steel or the pearlite block size as in Claim 9.

Regarding the high frequency hardening, Makino et al teaches a power transmission mechanism. Shafts of high torque are generally formed by subjecting steel to high frequency hardening [0003]. It would have been obvious to one of ordinary skill in the art at the time the invention was made to further treat the steel of Kanisawa with high frequency hardening, since Makino et al teaches that this step increases shaft strength in consideration of plastic workability, machinability and cost [0003]. Ochi et al teaches a high strength drive shaft and a process for producing the same (title). The steel is hot rolled at 700-850 C and then treated by induction hardening (which is the same as high frequency hardening) (column 6, lines 9-24). It would have been obvious to one of ordinary skill in the art at the time the invention was made to expect that the surface hardness after high frequency hardening would be at least either HRC 58 or HRC

61 (≥ 650 HV is equivalent to ≥ 58 HRC), since Ochi et al teaches the same temperature range for hot rolling. Further regarding the old austenite crystal grain size, it would have been obvious to one of ordinary skill in the art at the time the invention was made to expect that the grain size would be within the claimed range, since Kanisawa et al in view of Makino et al and Ochi et al teaches the same operating conditions.

Regarding the pearlite block size, Ishida et al teaches a non-heat treated steel used for manufacturing machine parts such as shafts [0001-0002]. The size of the pearlite blocks is less than 100 micrometers as shown in Table 2. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the size of the pearlite blocks as taught by Ishida et al, since Ishida et al teaches that to improve the straightening ability by bending of pearlite blocks, it is necessary to have the size of the blocks minimized [0015].

Claim 25 and 27-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 01156420 A in view of Makino et al.

JP '420 teaches making steel by hot rolling in the range of 700-850 C with a draft ratio of 5-10% (abstract). Regarding Claims 27 and 28, JP '420 teaches the following:

Element	Claim 27	Claim 28	JP '420
C	0.45-0.55%		0.1-0.5%
Si	0.21-0.45%		0.01-0.5%
Mn	0.50-1.20%		0.3-1.5%
Mo	0.15-0.25%		≤ 1.0%
Cr	n/a		≤ 1.0%
C_{eq}		0.80-0.95	0.149-1.70

C, Si and Mn are from the abstract, and Mo and Cr are from page 2. Regarding the recitation of "for use in a high strength pinion shaft", if the body of a claim fully and intrinsically sets forth all

of the limitations of the claimed invention, and the preamble merely states the intended use of the invention, rather than any distinct definition of any of the claimed invention's limitations, then the preamble is not considered a limitation and is no significance to claim construction. See MPEP § 2111.02. JP '420 does not disclose the hardness after hot rolling or high frequency hardening as in Claim 25, the ferrite ratio in Claim 29, the grain size in Claim 30 or the surface hardness in Claim 32.

Regarding the hardness and ferrite ratio for Claims 25 and 29, it would have been obvious to one of ordinary skill in the art at the time the invention was made to expect that the hardness and ferrite ratio in JP '420 would be within the claimed range, since JP '420 teaches substantially the same material using substantially the same rolling temperature conditions.

Regarding the high frequency hardening and grain size in Claims 25 and 30, Makino et al is applied as described above. Regarding Claim 25, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further treat the steel of JP '420 with high frequency hardening, since Makino et al teaches that this step increases shaft strength in consideration of plastic workability, machinability and cost [0003]. Regarding Claim 30, it would have been obvious to one of ordinary skill in the art at the time the invention was made to expect that the grain size in JP '420 in view of Makino et al would be within the claimed range, since JP '420 teaches substantially the same material using substantially the same rolling temperature conditions.

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '420 in view of Makino et al as applied to claim 25 above, and further in view of Ishida et al.

JP '420 in view of Makino et al discloses the invention substantially as claimed. However, JP '420 in view of Makino et al does not teach the pearlite block size as claimed. Ishida et al is applied as discussed above. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the size of the pearlite blocks as taught by Ishida et al, since Ishida et al teaches that to improve the straightening ability by bending of pearlite blocks, it is necessary to have the size of the blocks minimized [0015].

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '420 in view of Makino et al as applied to claim 25 above, and further in view of Ochi et al.

JP '420 in view of Makino et al discloses the invention substantially as claimed. However, JP '420 in view of Makino et al does not teach the surface hardness of the hardened steel as claimed. Ochi et al is applied as discussed above. It would have been obvious to one of ordinary skill in the art at the time the invention was made to expect that the surface hardness after high frequency hardening would be at least either HRC 58 or HRC 61 ($\geq$ 650 HV is equivalent to $\geq$ 58 HRC), since Ochi et al teaches the same temperature range for hot rolling.

Response to Arguments

Applicant's arguments filed 8/20/2009 have been fully considered but they are not persuasive. Kanisawa et al teaches a diameter reduction of at least 20%, which reads on the range of an area reduction of 10% or more. Kanisawa et al also teaches the presence of ferrite; the 3-phase texture does not exclude martensite.

Allowable Subject Matter

Claim 31 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: Kanisawa et al teaches a steel devoid of Cr, Cu, Ni and Al but a reduction of 20% or more, which does not read on a draft area reduction ratio of 10%. The area reduction by Kanisawa et al results in a better reduction of area than the comparative specimens. There is no basis to suggest modifying the area reduction in Kanisawa et al. JP '420 teaches Cu in the steel. There is no basis to suggest removing Cu from the steel in JP '420.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TIMA M. MCGUTHRY-BANKS whose telephone number is (571)272-2744. The examiner can normally be reached on M-F 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/George Wyszomierski/
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2 November 2009